

# BULLETIN

## OF THE INSTITUTE OF METALS

VOLUME 3

FEBRUARY 1957

PART 18

### INSTITUTE NEWS

#### 1957 Autumn Meeting in Glasgow

The Institute's 1957 Autumn Meeting will be held in Glasgow from Tuesday to Friday, 17-20 September, by kind invitation of the Scottish Local Section. Full particulars of this meeting will be published in due course.

#### Overseas Sustaining Membership

It is now generally accepted that, in present conditions, the important work carried out by technological and scientific societies such as the Institute of Metals cannot be sustained on an adequate scale by the annual subscriptions of the individual members, the great majority of whom are salaried members of the technical staffs of firms in the metallurgical and engineering industries or research workers in Government, university, or technical college departments.

For the past six years it has only been possible to maintain and develop the Institute's services because of generous annual financial support by Industry, the subscriptions from which have come from sources which are almost exclusively British.

The Institute's membership is international, and its services both to members and industry alike are offered on an international basis. Certain Corresponding Members, therefore, advised the Council that appropriate opportunities should be given to metallurgical and engineering companies, with headquarters located outside the United Kingdom, to offer annual financial support for the Institute's work through "Overseas Sustaining Membership", and effect was given to this suggestion last year by an appropriate amendment to the Institute's rules.

Overseas Sustaining Members are bodies corporate having their headquarters or principal places of business outside the United Kingdom and Northern Ireland which desire to give financial support to the objects and work of the Institute. They undertake to pay an annual subscription to the Institute of not less than £25 and are entitled to nominate two individuals (acceptable to the Council) for membership, whose subscriptions are included in the company subscription.

Up to 31 December 1956 the following 38 such bodies had taken up Overseas Sustaining Membership. The Council hopes that members resident outside the United Kingdom whose companies are not yet associated with this scheme will request their Boards to consider giving financial support to the Institute through Overseas Sustaining Membership.

Forms of application, giving extracts from the Articles of Association relating to this class of membership, may be obtained from the Secretary.

A list of British companies and other bodies which subscribe (but, in this case, without any privileges) will be found on pp. 278-279 of the March 1956 issue of the *Journal*.

#### *Australia :*

Broken Hill Associated Smelters Proprietary, Ltd., The.  
Broken Hill Proprietary Company, Ltd.  
Electrolytic Refining and Smelting Company of Australia Proprietary, Ltd.  
Electrolytic Zinc Company of Australasia, Ltd.

#### *Belgium :*

Compagnie des Métaux d'Overpelt-Lommel et Corphalie S.A.  
Laminaires et Tréfileries de Hal S.A.  
Visseries et Tréfileries Réunis S.A.

#### *Canada :*

Anaconda American Brass, Ltd.  
Atomic Energy of Canada, Ltd.  
Avro Aircraft, Ltd.  
Consolidated Mining and Smelting Company of Canada, Ltd., The.  
Crane, Ltd.  
Hydroelectric Power Commission of Ontario, The.  
Noranda Copper and Brass, Ltd.  
Orenda Engines, Ltd.

#### *Denmark :*

Aktieselskabet Nordiske Kabel-og Traadfabriker.  
Paul Bergsøe og Søn.

#### *France :*

Aluminium Français, L'.  
Compagnie Française des Métaux. (S.A.)  
Tréfileries et Laminaires du Havre.

#### *Netherlands :*

N.V. De Koninklijke Nederlandsche Lood-en Zinkpletterijen, voorheen A. D. Hamburger.  
Nederlandse Koperenbuizenfabriek N.V.  
N. V. Philips' Gloeilampenfabrieken.



### Switzerland :

Aktiengesellschaft Oederlin & Cie.  
Aluminum-Industrie A.G.  
Fonderie Boillat S.A.  
Metallwerke A.G.  
Schweizerische Metallwerke Selve & Co.

### United States of America :

Aluminum Company of America.  
Bristol Brass Corporation.  
Chicago Extruded Metals Company.  
Kenisco Copper Company, Inc.  
Lewin-Mathes Company.  
Mueller Brass Company.  
Revere Copper and Brass, Inc.  
Scovill Manufacturing Company.  
Triangle Conduit and Cable Company, Inc.  
Wolverine Tube, Division of Calumet and Hecla, Inc.

### Monograph No. 18 : "The Mechanism of Phase Transformations in Metals"

The monograph containing the papers contributed to the Symposium on "The Mechanism of Phase Transformations in Metals", organized by the Metal Physics Committee and held in London on 9 November 1955, has now been published.

The Symposium was divided into two parts: one dealt with nucleation-and-growth processes and the other with martensitic transformations. For each part a long and comprehensive review paper was invited, and this was followed by a number of shorter papers describing original work in the field concerned. There are in all 18 papers printed in the monograph, together with a full report of the discussion. The whole forms a valuable account of the present state of knowledge on this important subject of phase transformation.

Copies may be obtained at the following prices (post free):

Members (one copy only)	25s. od. (\$4.00)
Non-members	50s. od. (\$7.50)
Libraries	41s. 8d. (\$6.25)

### Monograph No. 20 : "The Final Forming and Shaping of Wrought Non-Ferrous Metals"

The Institute has now reprinted, in the form of a monograph, the eight papers contributed to the Symposium on "The Final Forming and Shaping of Wrought Non-Ferrous Metals", held at the Spring Meeting 1956, together with the discussion upon them. Contributions dealt with machining, deep drawing and spinning, rubber pressing, cold roll-forming and manipulation of sections, stretch-forming, bending and allied operations, and hot forming of magnesium alloys.

Copies are available at the following prices (post free):

Members (one copy only)	10s. 6d. (\$2.00)
Non-members	21s. od. (\$3.50)
Libraries	17s. 6d. (\$2.90)

### Monograph No. 21 : "The Foundations of Metallography" by Georg Masing

The Institute has just published a translation, by Professor F. C. Thompson, of "Grundlagen der Metallkunde in anschaulicher Darstellung", by the late Professor Georg Masing of Göttingen. This is an elementary textbook for students of metallurgy, which has proved very popular in Germany, being now in its fourth edition.

Professor Thompson, in a preface he has contributed to the English edition, writes: "There is abundant evidence that 'The Foundations of Metallography' has been written by a teacher of outstanding experience, with equal sympathy both for the theoretical and for the more practical points of view, and any reader who has conscientiously worked through this material cannot fail to have acquired a basic understanding of metallographic principles, on which foundation a sound superstructure can be built."

Believing that there is no comparable book in the English language, the Institute is placing this translation on the market at the lowest price possible under present-day conditions, in the hope that it will prove valuable to a great number of university and technical college students in English-speaking countries.

The prices are (post free):

Members (one copy only)	10s. 6d. (\$2.00)
Non-members	21s. od. (\$3.50)
Libraries	17s. 6d. (\$2.90)

### Annotated Equilibrium Diagrams

Three more systems have recently been added to the Institute's series of Annotated Equilibrium Diagrams. They are:

- No. 28. The Magnesium-Manganese System.
- No. 29. The Magnesium-Zinc System.
- No. 30. The Cobalt-Iron System.

The first two have been prepared by Professor W. R. D. JONES, D.Sc., F.I.M., of University College, Cardiff, and the third by Dr. A. HELLAWELL of Oxford.

The diagrams may be obtained from the Institute at the following prices (post free):

Members (one copy only)	1s. od. (\$0.40)
Non-members	2s. od. (\$0.50)
Libraries	1s. 8d. (\$0.40)

### "Metallurgical Reviews", Vol. 1, Part 4

The fourth part of Volume 1 of *Metallurgical Reviews*, recently published, contains two reviews: "Ion-Exchange Methods and Their Application to Metallurgical Problems", by Dr. C. B. AMPHLETT, and "Effect of Neutron Irradiation on Metals and Alloys", by Dr. A. H. COTTELL, F.R.S. Contents of the first three parts will be found on p. 28 of the advertisement section in the December 1956 issue of the *Journal*.

Copies of all issues of the first volume are still available and may be obtained, by (post free) annual subscription only, at the following rates: members 32s. 6d., non-members 42s. 6d. p.a.

### Election of Members

The following 1 Overseas Sustaining Member, 11 Ordinary Members, 3 Junior Members, and 8 Student Members were elected on 31 December 1956:

#### As Overseas Sustaining Member

LAMINOIRS ET TRÉFILERIES DE HAL S.A., Hal-lez-Bruxelles, Belgium.

#### As Ordinary Members

BARONI, Alberto, Dr. Ing., Direttore, Centro di Informazioni del Nickel, Corso Monforte 48, Milano, Italy.



## PERSONAL NOTES

- D'EGGIS, Ch.A., Ing., Chef du Service Technique, Laminoirs et Tréfileries de Hal S.A., Hal-lez-Bruxelles, Belgium.
- DOSSETT, David James, L.I.M., Metallurgist, Baker Platinum Division, Englehard Industries, Ltd., 154-170 Vauxhall Street, Kennington, London, S.E.11.
- GUSTIN, Jean-Pierre, Ing. Civ. Met., A.I.M., Directeur, Laminoirs et Tréfileries de Hal S.A., Hal-lez-Bruxelles, Belgium.
- HATCH, James Albert, B.S., President and General Manager, United Bronze Corporation, 1357 Franklin Street, Detroit 7, Mich., U.S.A.
- HAWKINS, John Fletcher, B.A., Development Metallurgist, Northern Aluminium Co., Ltd., Sales Development Division, Banbury, Oxon.
- NEUMANN, Erich, Dipl.-Ing., Works Manager, Felten & Guilleaume, Fabrik elektrischer Kabel-, Stahl- und Kupferwerke A.G., Werk Diemlach, Bruck/Mur, Austria.
- ÖSTBERG, Carl Gustaf, Met. Ing., Research Metallurgist, Falu Kopparverk, Falun, Sweden.
- SARMA, Arun Kanti Dutta, B.Sc., 61A Longridge Road, London, S.W.5.
- STECK, Alfred B., B.S., General Electric Co., 69 Norman Street, Everett 49, Mass., U.S.A.
- STRAUMANIS, Professor Martin Edward, Dr.Chem., Research Professor of Metallurgy, School of Mines and Metallurgy, University of Missouri, Rolla, Mo., U.S.A.

### *As Junior Members*

- HIGGS, David Slade, B.Sc., Research Investigator, British Non-Ferrous Metals Research Association, Euston Street, London, N.W.1.
- HUFFSTUTLER, Miles Conrad, Jr., B.S. (Ch.E.), M.Met.Eng., Research and Development Engineer, Experimental Foundry, The Dow Chemical Company, Midland, Mich., U.S.A.
- SHACKELL, Francis William, Shift Metallurgist, Guest, Keen Iron and Steel Co., Ltd., East Moors, Cardiff.

### *As Student Members*

- BLORE, Michael Hubert Dawson, Undergraduate, Department of Metallurgy, University of Sheffield.
- DOBSON, Rodney Munro, Undergraduate, Department of Metallurgy, University of Manchester.
- GREW, Maurice Alan, Imperial Chemical Industries, Ltd., Metals Division, Kynoch Works, Witton, Birmingham 6.
- HORNER, David, Metallurgical Assistant, P. W. Baker Co., Ltd., Windmill Road, Sunbury-on-Thames, Mddx.
- JEFFS, Alan Thomas, Undergraduate, Department of Metallurgy, University of Manchester.
- LITTAUER, Ernest Lucius, Student, Battersea College of Technology, London, S.W.11.
- NICHOLSON, Anthony, B.Sc., Research Student, Department of Metallurgy, University of Birmingham.
- SWINDELLS, Norman, Undergraduate, Department of Metallurgy, University of Manchester.

## PERSONAL NOTES

MR. S. ARMSTRONG is now a chemist on the staff of D. Napier and Sons, Ltd., Acton.

MR. W. BARR, Technical Director of Colvilles, Ltd., has been awarded the honour of Officer of the Order of the British Empire.

DR. M. L. BECKER has relinquished his position as Head of the Metallurgy Division of the British Iron and Steel Research Association and taken up an appointment as Technical Director of the Chrome-Alloying Co., Ltd., Hatfield, and of Diffusion Alloys, Ltd., London.

MR. T. BISHOP has relinquished his positions as Metallurgical Editor of *Iron and Coal Trades Review* and Editor of *Metal Treatment and Drop Forging* to join the metallurgical staff of John Miles and Partners (London), Ltd., consulting engineers for the metallurgical industries.

MR. JOHN GRAY BUCHANAN has retired as Chairman of William Jacks and Co., Ltd., but will retain a seat on the Board.

MR. W. G. BUCHANAN has been elected Chairman of William Jacks and Co., Ltd.

DR. L. H. CALLENDAR has retired from his position of Chief Chemist and Metallurgist with Crompton Parkinson, Ltd., Newport, Mon.

MR. H. E. DIXON has resigned his appointment as Chief Metallurgist, British Welding Research Association, and has joined Richardsons Westgarth Atomic, Ltd.

DR. S. F. DOREY retired from the post of Chief Engineer Surveyor of Lloyd's Register of Shipping on 31 December 1956, after 37 years' service. He served as President of the Institute in 1954-55.

DR. A. R. ENTWISLE has been appointed Lecturer in Metallurgy at Sheffield University.

MR. P. U. FISCHER has left Aluminium Industrie A.G., Zürich, and is now Foundry Manager of Aluminium Foils, Inc., Jackson, Tenn.

DR. ANDREW FLETCHER, President of the St. Joseph Lead Co., has been awarded the Charles F. Rand Medal of the American Institute of Mining and Metallurgical Engineers.

MR. B. FULLMAN, Chief Information Officer of the British Non-Ferrous Metals Research Association, has been awarded the honour of Member of the Order of the British Empire.

MR. H. A. HALUPKA has been appointed Mill Superintendent at the Hilton Mines, Shawville, P.Q., Canada.

MR. H. G. HERRINGTON, Managing Director of High Duty Alloys, Ltd., has been appointed Chairman of the Aluminium Industry Council, in succession to Sir Horace Clarke.

MR. W. C. F. HESSENBERG, Deputy Director of the British Iron and Steel Research Association, has been elected a Member of Council of the Iron and Steel Institute.

MR. P. T. HOULDCROFT has been appointed Chief Metallurgist of the British Welding Research Association in succession to Mr. H. E. Dixon.

MR. O. W. HUMPHREYS, Director of the Research Laboratories of The General Electric Co., Ltd., has been awarded the honour of Commander of the Order of the British Empire.

MR. H. D. JONES has left Round Oak Steelworks, Ltd., Brierley Hill, to become Lecturer in Metallurgy at the County Technical College, Wednesbury.

SIR ANDREW MCCANCE has succeeded Sir Ernest Lever as President of the British Iron and Steel Federation.



MR. J. Y. MANN has returned to the Aeronautical Research Laboratories, Melbourne, after spending about two years in Great Britain. During this time he was attached first to the Mechanical Engineering Research Laboratories and subsequently to the Metallurgy Department at Cambridge.

MR. J. E. ORAM has been appointed Managing Director of Wild-Barfield Electric Furnaces, Ltd., Watford. He was previously Director and General Manager.

PROFESSOR J. M. OTERO has been appointed Vice-President and General Manager of the Junta de Energía Nuclear (Spanish Nuclear Energy Board).

MR. G. W. PRESTON has resigned his position as General Manager of the Copper Development Association for reasons of health.

DR. W. I. PUMPHREY has received the D.Sc. degree of the University of Birmingham.

MR. E. ROBSON has been appointed a Director of Light-alloys, Ltd.

MR. H. C. ROSE has left the Atomic Energy Research Establishment, Harwell, and has taken up an appointment in the Research Laboratories of the Central Electricity Authority, Leatherhead, Surrey.

MR. W. S. SLATER has been appointed Deputy Chairman of Thomas Bolton and Sons, Ltd., Widnes.

MR. N. SMITH has left the Industrial Metallurgy Department at Birmingham University and is now engaged in the Research Laboratory of Rolls-Royce, Ltd., Derby.

DR. H. G. TAYLOR has been appointed Director of the Electrical Research Association. For the last nine years he has been Director of Research of the British Welding Research Association.

MR. F. WAINE has been appointed Chairman of Thomas Bolton and Sons, Ltd., Widnes.

MR. P. WYNBLATT has left the College of Technology, Manchester, and has been awarded a Graduate Fellowship at the Israel Institute of Technology, Haifa.

### Deaths

The Editor regrets to announce the deaths of:

MR. JOHN ROMAINE GOVETT, Chairman of Consolidated Zinc Corporation.

MR. JOHN EDWARD HOWARD, a student at Sheffield University, who was killed in a climbing accident on Snowdon on 17 November, 1956.

MR. WILLIAM MILLES MARTIN, O.B.E., formerly General Manager of Aluminium Hindustan, Ltd., Bombay.

MR. WILLIAM GLADSTONE MOCHRIE, Managing Director of Tyseley Metal Works, Ltd., Birmingham, on 29 November 1956.

MR. FRANCIS ERNEST STOKELD, Chief Chemist and Metallurgist of the Deritend Stamping Co., Ltd., Birmingham.

MR. REGINALD ERNEST LANHAM TRICKER, in the National Hospital for Nervous Diseases, on 22 December 1956. Mr. Tricker was Chief Metallurgist to S. Smith and Sons (England), Ltd.

## LETTERS TO THE EDITOR

### The Pyrometallurgy of Halides

Many metallurgists will be grateful to Dr. Kroll for his scholarly article on the pyrometallurgy of halides.<sup>1</sup>

One small point should perhaps be corrected. Dr. Kroll states (p. 317) that magnesium will reduce NaF but not KF. Actually magnesium reduces KF readily, and if the two liquids are mixed the reaction is mildly explosive.

Reduction of KF by magnesium would be expected on thermodynamic grounds, and the reversal of the order of the metals potassium, sodium, and magnesium between the chloride and fluoride electropotential series is a reflection of the differences in magnitude and sign of the heats of solution of their halides.<sup>2</sup>

E. F. EMLEY

*Magnesium Elektron, Ltd.,  
Swinton Junction,  
Manchester.*

### REFERENCES

1. W. J. Kroll, *Met. Rev.*, 1956, **1**, 291.
2. E. F. Emley, *Discussions Faraday Soc.*, 1948, (4), 219.

I wish to thank Dr. Emley for his statement, which I am ready to accept on account of his experience with fluoride fluxes. I presume that his experiments were performed with the oxide and HF-free fluoride, which latter, if contaminated in such a way, might react violently with magnesium. On the other hand, it would seem that the production of potassium by reduction of the fluoride with magnesium does not proceed as easily as suggested by Dr. Emley, if one considers the German Patent No. 500,331 (1927) of the I.G. Farbenindustrie, in which this reaction is proposed, though only for use *in vacuo* at 500°–700° C. In the commercial production of potassium the company abandoned magnesium in favour of calcium carbide, or silicon plus calcium oxide.

Some reader might take issue with my statement (see p. 298) that the vanadium present in raw  $TiCl_4$  is in the form of vanadyl dichloride,  $VOCl_2$ , instead of vanadium oxytrichloride,  $VOCl_3$ . The opinion of one of the main titanium producers of the U.S.A. is more in favour of the latter compound, which is yellow, whereas the former is green. It may however, be mentioned that vanadium tetrachloride might also be considered. This compound is reddish brown and stable in the presence of excess chlorine.

W. J. KROLL

*Cervallis,  
Oregon, U.S.A.*

### "Titanium" by A. D. McQuillan and M. K. McQuillan.

The recent book published by Dr. and Mrs. McQuillan<sup>1</sup> contains several erroneous implications and at least one error of fact in its report of the work we have done on the system titanium-iron.

(a) On pp. 218–219 it is stated: "Polonis and Parr<sup>92</sup> report that they have detected martensitically formed  $\alpha$  in water-quenched alloys containing up to 12 at.-% iron. The same workers have also studied the  $M_s$  temperature in titanium-iron alloys containing up to 2.2 at.-% iron, and have obtained results which conflict completely with those of Duwez. The  $M_s$  temperatures given by the two investigations differ by hundreds of degrees, and the slopes of the  $M_s$  temperature/composition curves appear to be of opposite sign. Polonis



and Parr,<sup>95</sup> whose work was done on powdered samples, attribute this disagreement to a difference in behaviour between materials in massive and powdered form, and point out that when they use compact specimens and quenching techniques the results are in agreement with those of Worner.<sup>90</sup> The technique used by Polonis and Parr for their powdered alloys depended, however, on a rather doubtful identification of the phases appearing in the microstructure of small powder particles, and it is possible, therefore, that their results are unreliable, the more especially as the increase in  $M_s$  temperature with increasing iron content reported as a result of their work implies that greater additions of iron could not stabilize the  $\beta$  phase."

The references cited in this passage are:

90. H. W. Worner, *J. Inst. Metals*, 1951-52, **80**, 213.
92. D. H. Polonis and J. G. Parr, *Trans. Amer. Inst. Min. Met. Eng.*, 1954, **200**, 1148.
95. D. H. Polonis and J. G. Parr, *ibid.*, 1955, **203**, 54.

We wish to make the following comments:

(1) The statement that the alloys were water-quenched is wrong. The description on p. 1149 of reference 92 makes it quite clear that our alloys were gas-quenched by a carefully controlled technique.

(2) The account of our paper (ref. 95) is confused almost beyond hope of our clarifying it. The authors seem to imply at one stage that the paper attempted to account for the disagreement between our values of  $M_s$  and those of Duwez. This paper did not mention  $M_s$ . Nor, in either of the papers (ref. 92 and 95), have we suggested that the disagreement of  $M_s$  values could be due to specimen size.

(3) We have already agreed with Jaffe<sup>2</sup> that our interpretation of results leading to our  $M_s$  temperatures was wrong. (We stress that the interpretation was wrong; we believe our identification of phases to be correct.) Although it may be argued that Dr. and Mrs. McQuillan wrote their book before this information was available to them, they were, in fact, aware of our opinions on the subject, since they wrote to us about our  $M_s$  values and we replied that we believed our  $M_s$  values to be in error.

(4) The account correctly implies that our paper (ref. 95) attempts to clarify the disagreement between our work (ref. 92) and that of Worner (ref. 90). However, the techniques described in reference 95 did not depend upon "a rather doubtful identification of phases appearing in the microstructure" but, as our paper clearly states, upon X-ray-diffraction analyses.

(5) A smaller inaccuracy is the reference to "compact specimens" which (to us) can mean only compacted powders. Our "massive" specimens in these tests were solids cut from ingots.

(b) The description of our work on  $Ti_2Fe$  (pp. 220-221) gives the impression that oxygen contamination in our alloys was high. We are sorry that Dr. and Mrs. McQuillan did not state that in the heat-treatments by which we produced  $Ti_2Fe$  the estimated combined oxygen and nitrogen pick-up was 0.03 at.-% (published in ref. 92). On the other hand, Van Thyne *et al.*,<sup>3</sup> whose work is quoted against ours, held their alloy "in a graphite crucible at 1105°C. . . for 20 min.". This technique seems to us to hold a possibility of contamination that Dr. and Mrs. McQuillan appear to ignore. (We mention this with no malice towards Van Thyne *et al.*, whose work we generally admire.) Perhaps we might mention that recent work by Ence and Margolin<sup>4</sup> confirms our assertion that  $Ti_2Fe$  does form in alloys which are sensibly free from oxygen.

(c) On pp. 77-78 of their book, Dr. and Mrs. McQuillan generously describe the levitation melting technique that we have had some part in developing. However, we do not know of any theory or experiment that has shown that "the problems of power supply restrict any possible extension of this process to larger melts . . ." (our italics). Scheibe<sup>5</sup> reports that 8 kg. of metal (we presume it to be steel) was supported and melted with the absorption of 50 kW. of power.

(d) More important, perhaps, is the statement that the technique of levitation melting "for the laboratory preparation of experimental alloys [it] cannot be said to have any obvious advantages over arc melting". It is well known that arc-melting methods do not always produce a homogeneous ingot; both severe coring and macro-segregation frequently occur, even after repeated remelting. Margolin *et al.*<sup>6</sup> have reported that even after several remeltings of titanium-nickel specimens, significant heterogeneity exists in an alloy button. So far, we have detected no heterogeneity in as-cast levitation-melted ingots, and we have reported this fact on several occasions. This, surely, is an "obvious advantage". A less important advantage, but one equally obvious to those who are familiar with the technique, is that it does not produce spatter, which, in laboratory arc-melting, often leads to tungsten contamination. In short, levitation melting is quick, clean, and elegant.

D. H. POLONIS

University of Washington,  
Seattle, Wash.,  
U.S.A.

J. GORDON PARR

University of Alberta,  
Edmonton, Alberta,  
Canada.

#### REFERENCES

1. A. D. McQuillan and M. K. McQuillan, "Titanium", 1955: London (Butterworths Scientific Publications).
2. L. D. Jaffe, *Trans. Amer. Inst. Min. Met. Eng.*, 1955, **203**, 718.
3. R. J. Van Thyne, H. D. Kessler, and M. Hansen, *Trans. Amer. Soc. Metals*, 1952, **44**, 974.
4. E. Ence and H. Margolin, *Trans. Amer. Inst. Min. Met. Eng.*, 1956, **206**, 572.
5. W. Scheibe, *Metall*, 1953, **7**, 751.
6. H. Margolin, E. Ence, and J. P. Nielsen, *Trans. Amer. Inst. Min. Met. Eng.*, 1953, **197**, 243.

The major difficulties confronting authors of books covering a wide field are those of compressing all that has been written on any aspect of a subject into manageable proportions and of reconciling conflicting views in a way which will present a balanced picture to a reader who has no specialized knowledge of the aspect in question. In contending with these difficulties authors are obliged to draw on their own experience, and include in their work an element of opinion as well as of fact for the benefit of those who are not in a position to judge for themselves. It is almost inevitable that the opinions expressed in such a book as ours will not coincide in every instance with those of the workers quoted, but we are sorry to find that Dr. Polonis and Dr. Parr take such strong exception to our necessarily brief discussion of their work. As they have done so, however, we feel that we should answer their objections point by point.

(a) (1) Our unfortunate use of the term "water-quench" instead of "gas-quench" was due to an error in transcription from notes and not to any misunderstanding on our part of



the nature of the technique employed. We have already apologized to Drs. Polonis and Parr, both through our publisher and in person, and are glad of the opportunity to do so publicly.

(2) We did not attempt to give an account of the Polonis and Parr paper (ref. 95), but extracted from it material relevant to the problem of the  $M_s$  temperature/composition relationship in the titanium-iron system. Although, as pointed out by the authors,  $M_s$  was not specifically mentioned, the paper dealt with the composition at which the formation of martensitic  $\alpha'$  can first be suppressed on quenching to room temperature, which is normally considered to be the composition at which the  $M_s$  temperature is equal to room temperature and is thus directly relevant to the location of the  $M_s$  temperature/composition curve. We had taken it that in attributing differences in the position of this one point on the curve to differences in specimen form, Polonis and Parr had implied that similar considerations would influence the position of the remainder of the curve. If this were not so, it would be so surprising that one wonders why Polonis and Parr did not mention it.

(3) The grounds for complaint on this point are not clear to us. The apparent implication that after writing to Polonis and Parr specifically to obtain their opinions regarding their  $M_s$  values we subsequently failed to take their views into consideration in our book is a false one. Some time after completing this section of the book, one of us wrote to Dr. Parr to ask for a reprint and mentioned incidentally that we had doubts about the  $M_s$  values given in the Polonis and Parr paper (ref. 92). In his reply, Dr. Parr merely observed that he, too, believed that the  $M_s$  values might be in error. Nothing was published on this point until after the book left our hands, and we saw no reason to change our manuscript in the light of Dr. Parr's brief comment, the more especially as he appeared to concur with our views.

Whatever may ultimately prove to have been the source of error in the  $M_s$  temperature determinations carried out by Polonis and Parr, we regard any technique depending entirely on accurate interpretation of decomposed  $\beta$  structures in titanium alloys as doubtful in the extreme, having ourselves experienced considerable difficulties in distinguishing with certainty between the various decomposition products of the  $\beta$  phase in systems of titanium with the transition elements. Support for this view may perhaps be found in the correspondence on the interpretation of microstructures in titanium-iron alloys which took place between Polonis and Parr<sup>1</sup> and Phillips<sup>2</sup> in this *Bulletin*. Consequently, in seeking possible reasons for Polonis and Parr's obviously inconsistent  $M_s$  results, misinterpretation of microstructures appeared to us to be a strong probability.

(4) As already pointed out, we did not realize at the time of writing our book that Polonis and Parr consider the composition at which the formation of martensite can just be suppressed on quenching from a temperature in the  $\beta$ -phase field to room temperature to be not necessarily connected with the  $M_s$  temperature/composition curve. Nor was it clear from the statement in reference 95 that "the hardness and constitution of powder samples were verified by repeating both types of quenching experiment described in the earlier paper" that this did not include the  $M_s$  work, which would come under the heading of a quenching experiment.

(5) Our use of the word "compact" for what Polonis and Parr call "massive" specimens is not inaccurate; had we meant "prepared from powders" we should have said "compacted". None of the alternative words sometimes

used in this connection, such as "solid" or "massive", conveys the required meaning.

(b) There are two reasons why we did not quote Polonis and Parr's figures for the oxygen contamination of their alloys. In the first place we doubt the accuracy of their oxygen determinations, which were based on microhardness measurements; and secondly, readers who have not worked in this particular field are unlikely to know whether 0.03 at.-% oxygen or nitrogen would be significant or not, and we preferred to give them a comparative statement of the level of contamination.

Polonis and Parr are in error in stating that we have quoted against theirs, work by Van Thyne, Kessler, and Hansen in which an alloy was held in a graphite crucible at 1105°C. for 20 min. The greater part of the work reported by Van Thyne *et al.*, including the heat-treatments which would have produced Ti<sub>2</sub>Fe by reaction between the  $\beta$  solid solution and TiFe had the process observed by Polonis and Parr occurred in their alloys, was carried out under conditions certainly not more likely to result in specimen contamination than those of the latter workers. Only a single experiment designed to test specifically the possibility that Ti<sub>2</sub>Fe might be formed by a peritectic reaction between the melt and TiFe was carried out in a graphite crucible, since it was difficult to cool sufficiently slowly from the melt by any other means. We referred to the remainder of the work by Van Thyne, *et al.*, and not to this single test, the results of which are irrelevant to the matter under discussion.

(c) We do not feel that the use of the levitation melting technique for 8-kg. melts of metal conflicts in any way with our statement that any extension of the laboratory process which may be possible will be restricted by problems of power supply.

(d) The relative merits of laboratory-scale arc- and levitation-melting must remain a matter of opinion, and we retain that expressed in our book. During a recent visit to America, we sought views on this point from workers in three or four laboratories in which both types of furnace were available. The majority normally used arc-melting, and in only one laboratory we visited was the levitation method used regularly for the preparation of titanium alloys.

A. D. McQUILLAN

*Metallurgy Department,  
Birmingham University.*

M. K. McQUILLAN

*Research Department,  
Imperial Chemical Industries, Ltd. (Metals Division)  
Birmingham.*

#### REFERENCES

1. D. H. Polonis and J. G. Parr, *Bull. Inst. Metals*, 1954-55, **2**, (14) 162.
2. C. W. Phillips, *ibid.*, 1954-55, **2**, (20), 233.

## JOINT ACTIVITIES

### Mond Nickel Fellowships

The Mond Nickel Fellowships Committee announced recently the award of two Fellowships for 1956 to the following applicants:

MR. R. BANDY (The English Steel Tool Corporation, Ltd.) to study in the United Kingdom, Europe, and North America metallurgical research, production methods, and quality control with respect to tool steels.



DR. J. HARGREAVES (The United Steel Companies, Ltd.) to study the changes in design, construction, and methods of operation of steelmaking and processing furnaces which are being introduced in the United Kingdom, Europe, and the United States to increase the rate and efficiency of production.

The Mond Nickel Fellowships Committee now invites applications for the award of Mond Nickel Fellowships for the year 1957. Awards will be made to selected applicants of British nationality educated to University degree or similar standard, though not necessarily qualified in metallurgy, who wish to undergo a programme of training in industrial establishments; they will normally take the form of travelling Fellowships and awards for training at universities will be made only in exceptional circumstances. There are no age limits, though awards will seldom be given to persons over 35 years of age. Each Fellowship will occupy one full working year. The Committee hopes to award up to five Fellowships each year of an approximate value of £900 to £1200 each.

Mond Nickel Fellowships will be awarded in furtherance of the following objects:

(a) To allow selected persons to pursue such training as will make them better capable of applying the results of research to the problems and processes of the British metallurgical and metal-using industries.

(b) To increase the number of persons who, if they are subsequently employed in executive and administrative positions in the British metallurgical and metal-using industries, will be competent to appreciate the technological significance of research and its results.

(c) To assist persons with qualifications in metallurgy to obtain additional training helpful in enabling them ultimately to assume executive and administrative positions in British metallurgical and metal-using industries.

(d) To provide training facilities whereby persons qualified in sciences other than metallurgy may be attracted into the metallurgical field and may help to alleviate the shortage of qualified metallurgists available to industry.

Applicants will be required to state the programme of training in respect of which they are applying for an award, as well as particulars of their education, qualifications, and previous career. Full particulars and form of application can be obtained from: The Secretary, Mond Nickel Fellowships Committee, 4 Grosvenor Gardens, London, S.W.1.

Completed application forms will be required to reach the Secretary of the Committee not later than 1 June 1957.

## DIARY

### Local Sections and Associated Societies

- 5 March. **Oxford Local Section.** "The Writing of Scientific Papers", by Dr. W. Hume-Rothery. (Cadena Café, Cornmarket Street, Oxford, at 7.0 p.m.)
- 7 March. **Leeds Metallurgical Society.** "The Study of Wear and Lubrication Using Radioisotopes", by J. B. P. Williamson. (Large Chemistry Lecture Theatre, The University, Leeds 2, at 7.15 p.m.)
- 7 March. **London Local Section.** "Gas in Light Alloys", by Dr. C. E. Ransley. (17 Belgrave Square, London, S.W.1, at 6.30 p.m.)
- 11 March. **Scottish Local Section.** "Production and Uses of Rare Metals", by Dr. J. C. Chaston, followed by the Annual General Meeting. (Institution of Engineers

and Shipbuilders in Scotland, 39 Elmbank Crescent, Glasgow, C.2, at 6.30 p.m.)

- 12 March. **South Wales Local Section.** "Clad Metals", by Professor A. R. E. Singer. (Department of Metallurgy, University College, Singleton Park, Swansea, at 6.45 p.m.)
- 13 March. **Manchester Metallurgical Society.** "Precision Casting by the Shaw Process", by N. Shaw. (Manchester Room of The Central Library, Manchester, at 6.30 p.m.)
- 14 March. **Birmingham Local Section.** Annual General Meeting. (Birmingham Exchange and Engineering Centre, Stephenson Place, Birmingham, at 6.30 p.m.)
- 18 March. **Sheffield Local Section.** "Materials of Construction in the Heavy Chemical Industry", by F. H. Keating. (Engineering Lecture Theatre, The University, St. George's Square, Sheffield 1, at 7.30 p.m.)
- 20 March. **Liverpool Metallurgical Society.** Visit to Works of High Speed Steel Alloys, Ltd., Widnes.
- 21 March. **Liverpool Metallurgical Society.** "Steel at Elevated Temperatures", by J. D. Murray. (Liverpool Engineering Society, 9 The Temple, Dale Street, Liverpool, at 7.0 p.m.)

### Other Societies

- 4 March. **East Midlands Metallurgical Society.** "Recent Developments in Metallography", by Dr. D. McLean. (Lecture Theatre, Derby and District College of Art, Green Lane, Derby, at 7.30 p.m.)
- 12 March. **Royal Aeronautical Society.** Section Lecture: "High-Temperature Materials for Engines", by E. R. Gadd. (Library, 4 Hamilton Place, London, W.1, at 7.0 p.m.)
- 13 March. **Royal Institute of Chemistry, London Section.** "Zone Refining", by N. Parr. (4 Grosvenor Gardens, London, S. W.1, at 6.30 p.m.)
- 15 March. **West of Scotland Iron and Steel Institute.** "A Review of Some Rolling-Mill Engineering Practices", by F. G. Thomson. (39 Elmbank Crescent, Glasgow, C.2, at 6.45 p.m.)
- 19 March. **Institute of British Foundrymen, East Anglian Section.** "Practical Implications of Research on the Casting of Non-Ferrous Metals", by E. C. Mantle. (Lecture Hall, Public Library, Ipswich, at 7.30 p.m.)
- 21 March. **Society of Chemical Industry, Corrosion Group.** Symposium on Corrosion of Metals in Buildings: "The Resistance to Corrosion of Non-Ferrous Metals in Buildings", by F. E. Jones; "The Corrosion of Ferrous Metals in Buildings", by J. C. Hudson and F. Wormwell; "Corrosion of Metals in Contact with Concrete", by P. E. Halstead; "Aluminium Cladding of Buildings", by E. H. Laithwaite and E. W. Skerrey; "The Performance of Zinc and Zinc Coatings in Buildings", by R. W. Bailey and H. G. Ridge; "The Behaviour of Copper in Buildings", by S. Baker and E. Carr. (Joint meeting with Road and Building Materials Group). (At 9.30 a.m. and 2.30 p.m. Meeting place to be announced later.)
- 27 March. **Institute of British Foundrymen, London Branch.** "Latest Practices in Shell Moulding and Core-making", by D. H. Scott. (Constitutional Club, Northumberland Avenue, London, W.C.2, at 7.30 p.m.)



# APPOINTMENTS VACANT

**HIGH DUTY ALLOYS, LTD., RESEARCH DIVISION, SLOUGH, BUCKS.** Experienced light-alloy rolling-mill Metallurgist required to work on research problems associated with production. Applicants should preferably have a degree or its equivalent and several years' experience of the technical control of light-alloy sheet production. The successful candidate will be expected to pay regular visits to the Rolling Division in South Wales and to pursue actively his investigations in the Research Laboratories. This is a senior appointment, and the salary paid will be commensurate with qualifications and experience. There is a pension scheme in operation. Apply, giving full details, to the Staff Manager, address as above.

**HIGH DUTY ALLOYS, LTD., RESEARCH DIVISION, SLOUGH, BUCKS.** Metallurgist or Physicist required to take charge of the Metallographic and Photographic Sections of the Research Laboratories. Candidates should have a good Honours Degree or its equivalent, with several years' experience, including modern metallographic techniques, in the light-alloy or non-ferrous industries. This is a senior appointment, and the starting salary envisaged for a suitably qualified and experienced person is up to £1,200 per annum. There is a pension scheme in operation. Candidates should apply, giving full details, to the Staff Manager, address as above.

**IMPERIAL SMELTING CORPORATION, LTD.,** has vacancies in the Development Department for Extraction Metallurgists or Physical Chemists with independence of thought who are prepared to undertake work of a varied nature both on new developments and involving investigations into the efficiency of established processes. Applications are invited from persons with an honours degree in Metallurgy or Chemistry who have completed, or are free from, National Service obligations. Previous industrial experience, although not essential, would be advantageous. Initial applications to Personnel Manager, Imperial Smelting Corporation, Ltd., St. Andrew's Road, Avonmouth, Bristol, quoting reference BD/IM.

**METALLURGIST** aged 22-25 years required to assist in the Metallurgical Laboratory of a company in North-East England manufacturing plant for the steel, gas, chemical, and petroleum industries. The work is of a varied nature and covers ferrous and non-ferrous weld metallurgy, Meehanite castings, and special investigations. Applicants should possess a university degree or be Licentiates of the Institution of Metallurgists. Apply Box No. 421, The Institute of Metals, 17 Belgrave Square, London, S.W.1.

**METALLURGIST** required to direct the activities of group engaged on research into the melting, metal treatment, and casting of aluminium alloys intended for fabrication by rolling, extrusion, and forging. The work involves both basic and applied research and demands a university graduate of several years' experience. Excellent working conditions. Pension and Life Assurance Scheme in operation. Apply to: Personnel Officer, Aluminium Laboratories Limited, Banbury, Oxon.

**METALLURGISTS or METALLURGICAL CHEMISTS** B.Sc. or equivalent, required for Tin Smelting Works in Singapore and Malaya. Age 22/30. Single. First-class passage and free furnished quarters provided. Provident fund. Salary according to qualifications and experience, but not less than £1200 p.a. Apply, giving full details of age, education, qualifications and experience, National Service, &c., to Box No. 423, The Institute of Metals, 17 Belgrave Square, London, S.W.1.

**METALLURGIST or PHYSICIST**, preferably having experience of electron microscopy or X-ray crystallography in connection with metals, required for research on age-hardening phenomena in aluminium alloys. Salary up to £800 p.a., depending on qualifications. Applications to Dr. M. S. Fisher, Metallurgy Department, Imperial College, London, S.W.7.

**QUEEN'S UNIVERSITY, KINGSTON, ONTARIO.** Professor of Physical Metallurgy. Duties mainly research, although some teaching essential. For details apply: Dean H. G. Conn, Queen's University, Kingston, Ont., Canada.

**SALES MANAGER** required for Manufacturers of Centrifugal Castings in non-ferrous alloys. Must have experience and established contacts with buyers of non-ferrous castings, not necessarily centrifugal. Good salary and commission to first-class man, age 35-40, with prospects of becoming Assistant to Managing Director. Apply Box No. 424, The Institute of Metals, 17 Belgrave Square, London, S.W.1.

## THE MULLARD RADIO VALVE CO., LTD.,

Materials Research Laboratory, requires a

### GRADUATE METALLURGIST

or a person with similar qualifications to undertake interesting and varied work in the Materials Research Laboratory on the investigation of a range of materials for use in the electronic field. The commencing salary will be according to ability, experience and qualifications, and can be regarded as competitive in this field.

Employee benefits, Pension Scheme, holiday plans have long been established with this company, and applications should be addressed to the Personnel Officer, The Mullard Radio Valve Co., Ltd., New Road, Mitcham Junction, Surrey, quoting reference JFG/MR1.

**WELDING ENGINEER** (Graduate or Equivalent) required by ORENDA ENGINES, LTD., Malton, Ontario. This is a senior position requiring a University Graduate or A.I.M. who has at least three years' experience in metallurgical engineering as applied to welding problems.

This position requires the development and control of all types of welding techniques on materials currently in use and in development for the jet-engine industry.

The company operates a non-contributory Life, Sickness, and Accident Insurance for employees and their dependants.

Contributory pension plan after two years' service.

Successful applicant will be granted assistance towards transportation to Canada.

Apply in writing to: G. L. Humphrey, Orenda Engines, Ltd., 18, St. James's Square, London, S.W.1.

## UNIVERSITY OF BIRMINGHAM GRADUATE COURSE IN METALLURGY

A course in modern developments in metallurgy and their industrial applications, organized by the Department of Industrial Metallurgy and extending over three terms, will begin on 7 October, 1957.

The course, which provides training for those engaged in or proposing to enter metallurgical industry, is open to men holding degrees or equivalent qualifications in metallurgy, physics, chemistry, or engineering; leading to a diploma in graduate studies or, in suitable cases, to a M.Sc. degree.

Graduates wishing to be considered for the Advanced Course Studentships of the D.S.I.R. must apply to the Registrar immediately. Full particulars of the course may be obtained from the Registrar, the University, Birmingham 15.